MOBILE AND VOICE CONTROLLED SMART SWITCH FOR HOME AUTOMATION

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ABSTRACT

This work describes the implementation of a Bluetooth technology and an android application with voice prompts-based home-automated system using an Arduino microcontroller. The system is aimed at designing an automated appliance control that is user-friendly and convenient to use. The design comprised an Arduino microcontroller board, Bluetooth module, and an android application. The Arduino controls any connected component and was programmed with C++ programming language by using Integrated Development Environment (IDE). Relays are used for the switching mechanism. Once the system is connected, the user controls the electrical appliances connected to the home-automated system, which can also be controlled using voice prompt with the help of an inbuilt voice assistant with the android smartphone. The system switches the home appliances ON and OFF using the android app, Bluetooth module, and voiced prompt.

Keywords: Bluetooth technology, voice prompts, mobile and voice-controlled switch, home automation.

1. INTRODUCTION

Home automation is the use of one or more computerized remote to control basic home appliances remotely and sometimes automatically [1]. It is designed to contr1ol lighting points, entertainment systems, and home security such as access control as well as alarm systems. Automation and wireless technology have become a key technology in the twenty-first century. It helps communication between one point to another without the use of cables, and this makes the system to be more secure [2]. The attractiveness of controlling electrical devices through a phone has been increasing because of its high performance and availability. Connecting appliances through smartphone is useful for the elderly and physically disabled persons, who can access and control the appliances from where they are located and access them remotely without the help of others. Time is a precious thing; everybody wants to save time as much as they can [3, 4].

Home automation systems are a technological means of intelligent monitoring, control, feedbacks, and actions of home appliances according to the needs of the home occupants. Wireless medium such as ZigBee, Bluetooth, wireless Fidelity (Wi Fi), Short Message Service (SMS), Android Application, Wireless Sensor Network (WSN), Radio frequency identification (RFID) and Software Defined Network just mention a few serves as a medium of communication between the appliances and the control unit and according to [5] home automation are essential for non-invasive and non-intrusive implementation of the advanced automation system.

Android, a vivid operating system, has 76.24% usage worldwide, and 78.05% of Nigeria's total smartphone market share [6]. Android has become the topmost used mobile gadget operating system (OS) on the market today. The Android smartphone has become the most popular and commonly used

Operating System in our world, especially in Nigeria. This had made us base the control terminal of the home automated system on an android application as it has been shown that majority cannot do without their phone with them almost all the time.

Conventional home-controlled systems and its components are all wired to the same cable that connects them to the home control panel. The key problem with conventional home-controlled systems is that they require the mobility of the user to operate it, hence the need for automation.

2. LITERATURE SURVEY

Also, Pandya et al. [1] also presented a Bluetooth-based home automation, but the only difference is that it had an authentication mechanism that made it secure and accessible to authorized users.

In the same vein, Nisar et al. [5] proposed a smart home automation for the elderly using Wireless sensor network and android application, the system was divided into modules namely sensor, control, and actuator. The sensor module served as the transmitting medium, the control module controlled the smart house, remote monitoring of other sub-modules and the actuator modules showed the response of all appliances connected in the actual system as illustration, the drawback of this system is that failure to the control modules is failure of the whole system.

Radio frequency identification (RFID) was used to design and monitor the indoor activity of elderly people in a smart home by Nisar et al. [7]. The RFID monitored and collected the movement activity of the elder person using RFID tags, information collected was used to take critical decisions about the health of the elderly person. But RFID can't work where its radio waves do not cover.

Similarly, Nisar and Ibrahim [8] presented A Smart Home Model Using Android Application where the vital signs of the elderly are monitored. A communication module and sensors such as accelerometer, gyroscope, force and temperature were attached to the knee and walking analyzer to monitor and extract of a person's unique walking pattern, which is used to classify the walking pattern an individual whether walking anomaly and walking with a level of stability. The signals are taken by the sensors and information gathered from walking analyzer and knee monitor was used to design a smart sleep room where vital signs like body temperature, breathing patterns and cardiac are monitored these signs are sent through a smartphone and a local wireless network to monitor elderly persons' health. The processes involved in this design are too cumbersome and if sensors are not properly attached signal might fail and waking pattern will not be got.

Also, Nisar and Ibrahim [9] proposed "a smart home model using android application" the home model uses ZigBee module to communicate between the android phone and the smart home model. This is not an effective medium of communication, as an external ZigBee transceiver must be connected to the android phone. This leads to waste in power, use of many components as compared to Bluetooth that is part of an android phone already.

Furthermore, Wanjale et al. [10] designed and implemented an Android application with a Bluetooth module and Arduino UNO board for home-based automation. Users can interact with the android phone and send a control signal to the Arduino UNO that will control other embedded devices/sensors. Similarly, Tyagi et al. [11] controlled home appliances through voice commands with Arduino and Android OS. In the same vein, Sriskanthan and Karande [12] networked all home appliances and controlled them through Bluetooth. The network contained a remote, mobile host controller and home appliances. The home appliance communicated with the host controller through the Bluetooth devices, which operated the home appliances through a RS232 network using Bluetooth module. Yuksekkaya et al. [13] developed a GSM, Internet, and speech recognition-based home appliances automation. The Signals from the Radio Frequency (RF) antenna were processed by the

microprocessor, which in turn was used to control the appliances. Teymourzadeh et al. [14] designed and implemented a smart home automation system based on a mobile phone and GSM modem. In this design, an incoming message was sent from the user phone to the GSM modem as a text message via the cellular network. It then decodes the SMS to activate the connected appliances; this is not a cost-effective method of automation, as there is no means of getting feedback from the system. Jubadi and Zulkifli [15] proposed how to use a Television (TV) remote control to control room lighting and other appliances in their work entitled "Programmable Infrared Accessory Light Switch". An Infrared (IR) remote and one IR receiver was programmed to store the frequency of the existing remote and use them directly to control appliances. Gurek et al. [16] explored internet-based home appliance connectivity but, a major demerit is this: when there is no internet connectivity, the system fails especially in a country like Nigeria. Diarah et al. [17] in their work titled, "Design and Implementation of a Microcontroller Based Home Automation System Using Aiwa Remote", explore the use of television remote to control home appliances, this is not efficient as users must be physically present to activate the system by pointing the remote towards the appliance.

3. PROPOSED SYSTEM

This is voice-controlled automation environment for home appliances controller. Initially, Arduino is connected to the Bluetooth module. Here user gives the voice commands through mobile application. The user gives commands like "Good Morning", and "Bye" etc. Here load 1 indicates Blub, load 2 indicates power supply sockets. Here, the good morning command triggers the relay drivers and turn on "light". Similarly, bye command triggers the relay drivers and turns off the Bulb.

3.1 Block Diagram

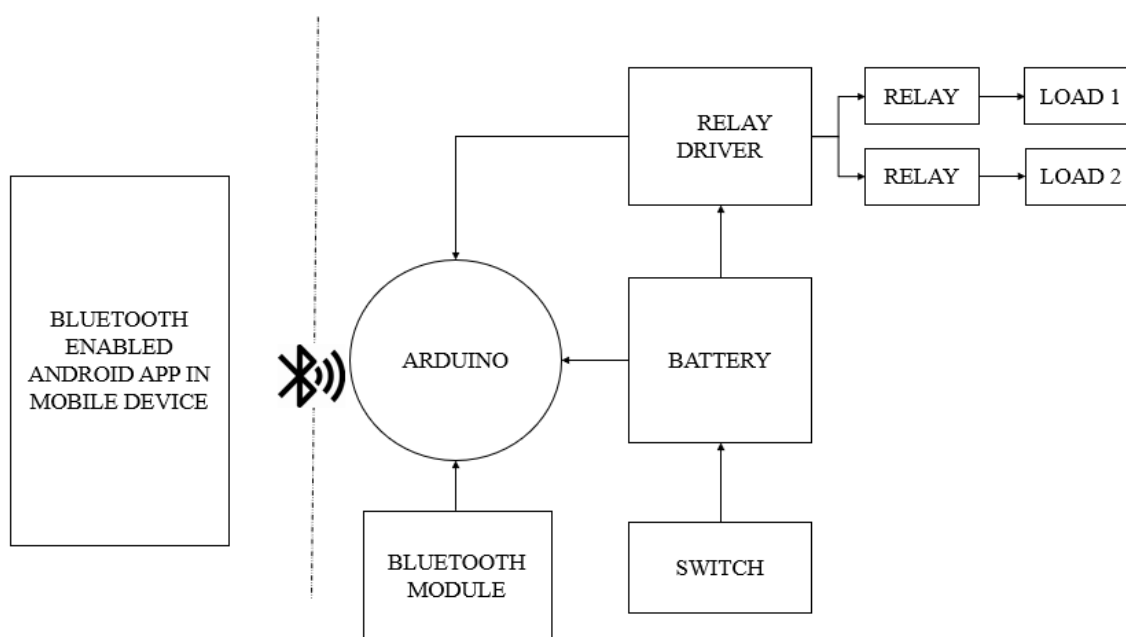

Fig. 1: Block diagram of mobile and voice controlled smart switch for home automation.

3.2 Arduino Nano

The Arduino Uno and Nano are similar, but the only difference is that its size. The UNO size is 2 times the Nano size, so the Arduino Nano is more breadboard friendly. It is used for portable projects. The board has a mini-USB cable slot.
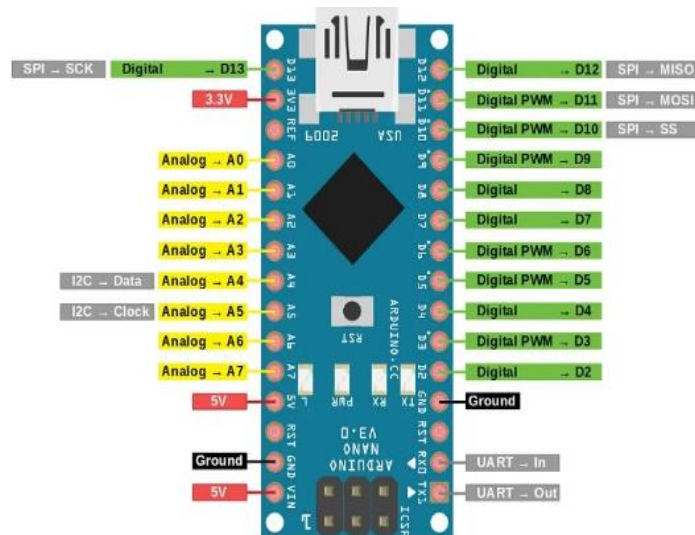
Fig. 2: Arduino Nano.

3.3 Relay

A relay is an electromagnetic switch that opens and closes circuits electromechanically or electronically. A relatively small electric current that can turn on or off a much larger electric current operates a relay. Relays work like some electrical products since they receive an electrical signal and send the signal to other equipment by turning the switch on and off. Even if the relay contact is normally closed or normally open, they are not energized. Its state will change only if you apply an electrical current to the contacts.
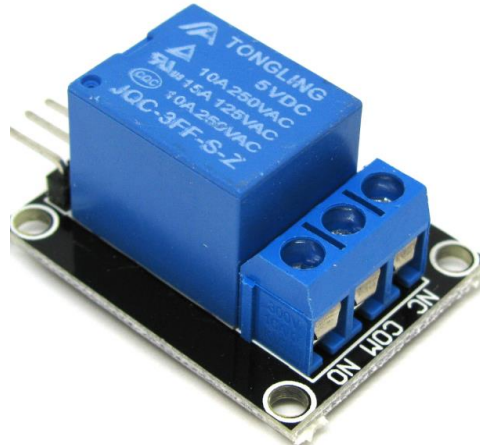

Fig. 3: Relay.

3.4 Bluetooth Module

HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.
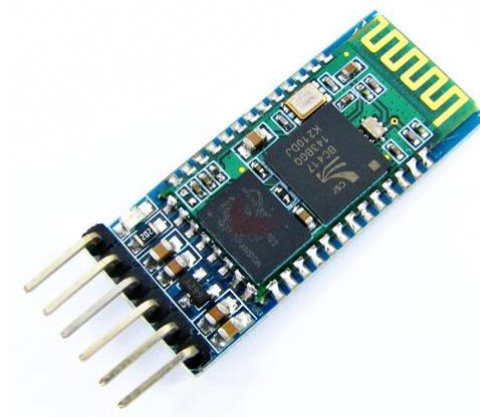
Fig. 4: HC-05 Bluetooth module.

3.5 Switch

A switch is an electrical component that can disconnect or connect the conducting path in an electrical circuit, interrupting the electric current or diverting it from one conductor to another. The most common type of switch is an electromechanical device consisting of one or more sets of movable electrical contacts connected to external circuits. When a pair of contacts is touching current can pass between them, while when the contacts are separated no current can flow.
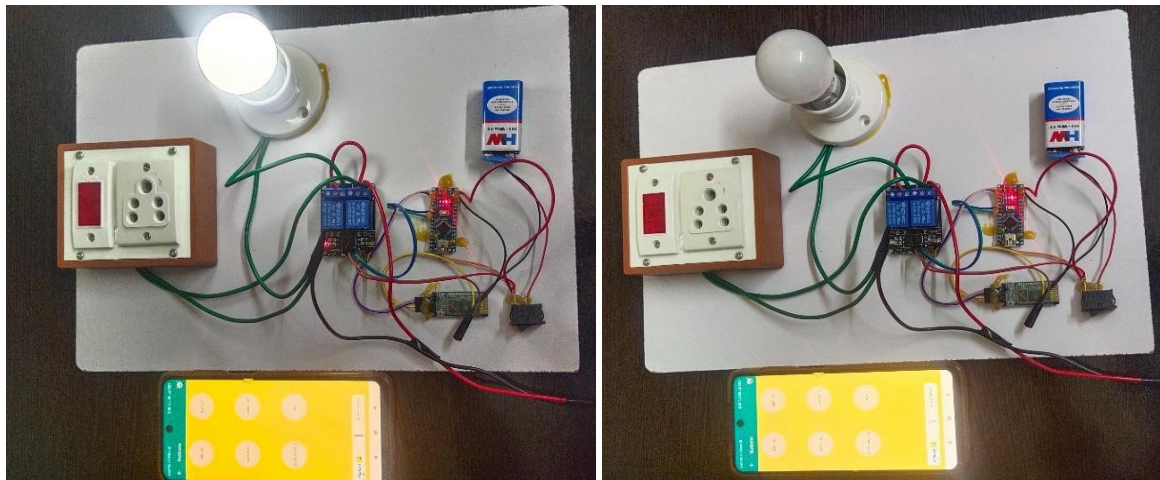

Fig. 5: Switch.

3.6 Blub

An electronic bulb is a small and simple light source that uses a wire filament to glow on the application of electricity. The structure of incandescent light bulbs is shown in the figure below.

Glass bulb
Glass filling
Tungsten filament
Support wires
Lead wires
Dumet wire
Stem
Cap
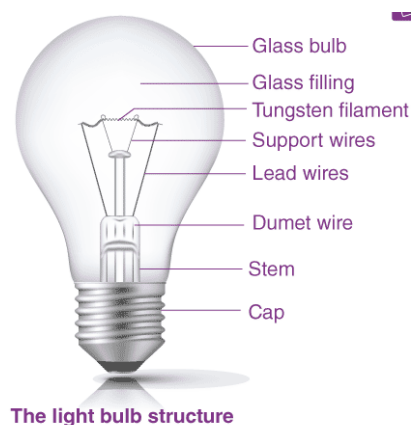
The light bulb structure

Fig. 6: Bulb.

4. RESULTS

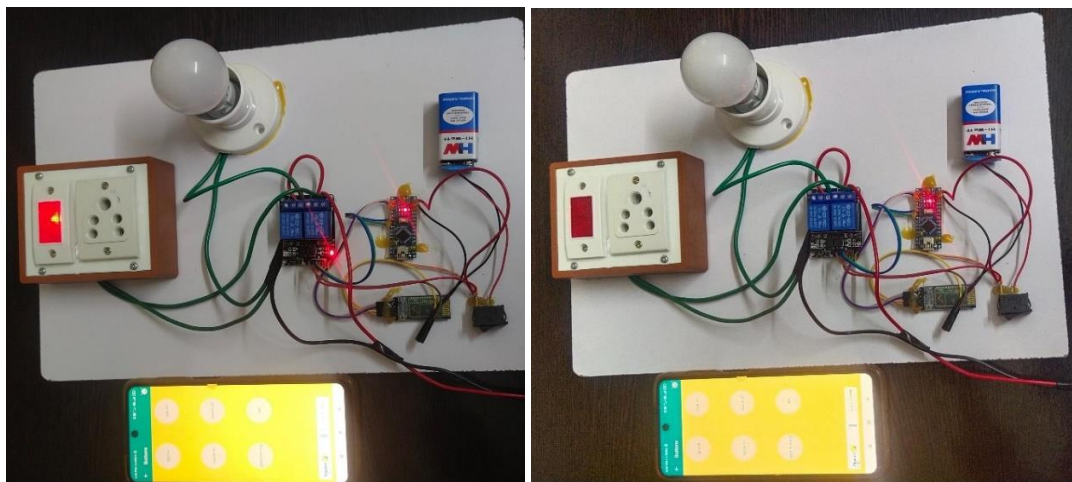(a)   (b)
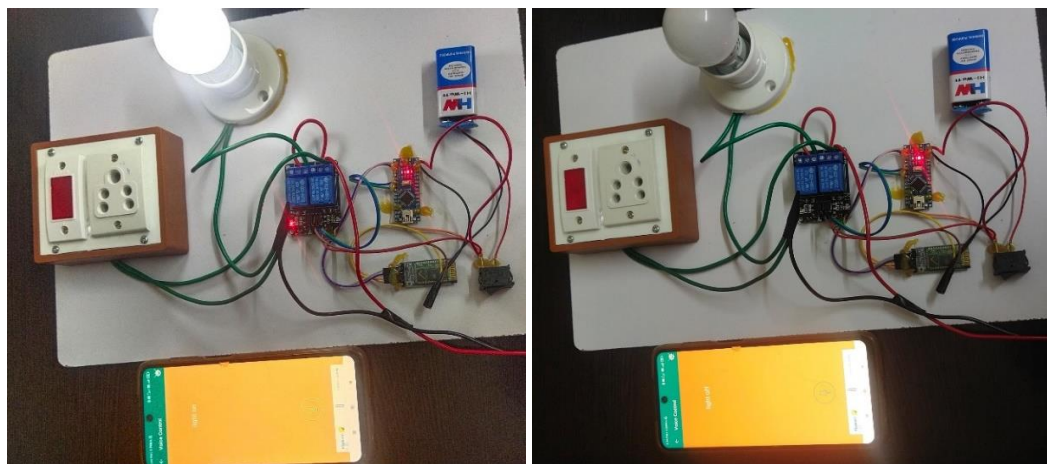
Fig. 7: Hardware setup with (a) light on condition, (b) light off condition.

(a)   (b)

Fig. 8: Hardware setup with (a) socket on condition, (b) socket off condition.

(a)   (b)

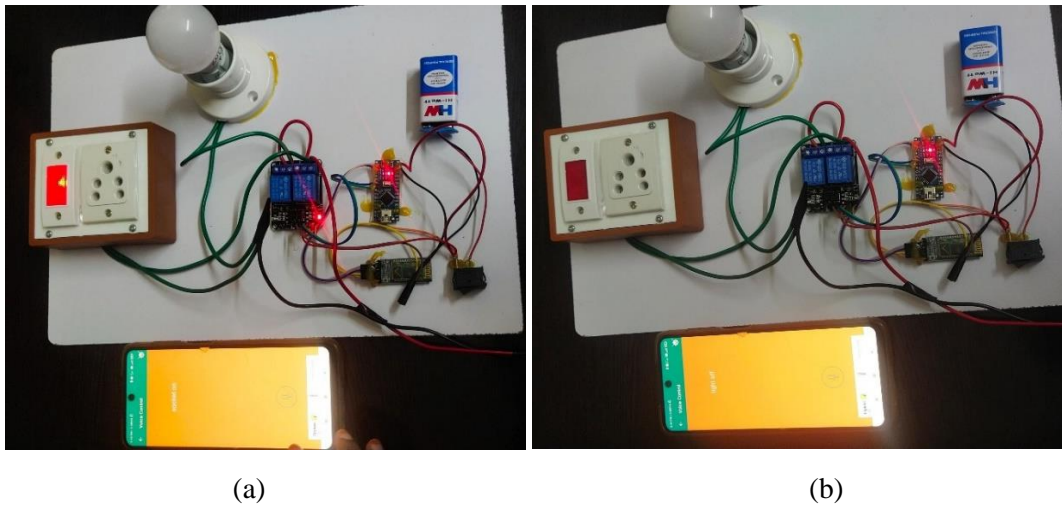Fig. 9: Voice setup with (a) light on condition, (b) light off condition.

(a)   (b)

Fig. 10: Voice setup with (a) socket on condition, (b) socket off condition.

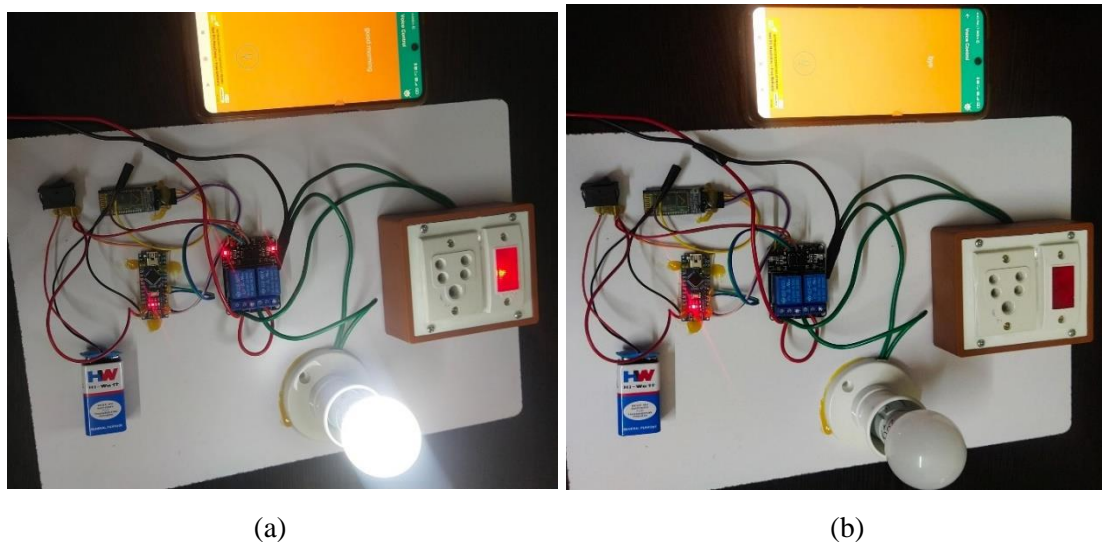(a)   (b)

Fig. 11: Voice setup with (a) good morning condition, (b) bye condition.

5. CONCLUSION

This work described the implementation of a Bluetooth technology and an android application with voice prompts-based home-automated system using an Arduino microcontroller Relays are used for the switching mechanism. The user controlled the electrical appliances connected to the home-automated system, which can also be controlled using voice prompt with the help of an inbuilt voice assistant with the android smartphone. The system switches the home appliances ON and OFF using the android app, Bluetooth module, and voiced prompt.

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